

**ARRHENOCNEMIS PARVIBULLIS SP. NOV. (ODONATA:
PLATYCNEMIDIDAE), A NEW CALICNEMIINE DAMSELFLY
FROM PAPUA NEW GUINEA, WITH A DESCRIPTION OF THE
FEMALE OF *A. AMPHIDACTYLIS* LIEFTINCK, 1949.**

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Abstract

A new species of damselfly, *Arrhenocnemis parvibullis* (Odonata: Platycnemididae), from the Muller Range of Papua New Guinea is described and its habits and habitat discussed. It represents the third species of this distinctive genus, known from just 16 specimens. The recently discovered female of *A. amphidactylis* is described for the first time.

Introduction

The zygopteran family Platycnemididae is widely distributed in the Old World. Until recently it was not included in the Australian fauna, but according to Carle *et al.* (2008), the protoneurid subfamily Disparoneurinae, which includes many Australasian representatives, may belong in the Platycnemididae, and it is thus treated by Theischinger and Endersby (2010). The subfamily Calicnemiinae however, first recognised by Fraser (1957), has a more enigmatic distribution. The 21 recognised genera range from tropical Africa and Madagascar to Sundaland and the Philippines, New Guinea and the Solomon Islands, but are absent from Sulawesi, the Moluccas and the Lesser Sunda Islands (Gassmann 2005). The New Guinea and Solomon Island fauna is believed to have derived from the Philippines, dispersing along now submerged island arcs from about 25 million years b.p. (van Tol and Gassmann 2005). The close affinity between the Philippine and New Guinean representatives is supported by the fact that in the highly speciose Philippine endemic nominotypic subgenus *Risiocnemis*, and in nine of the ten known New Guinea or Solomon Island endemic genera, the wing tip and distal hind margin of both wings is strongly crenulated, a character unique among the Odonata.

One of the more distinctive New Guinean genera is *Arrhenocnemis* Lieftinck, 1933, until recently known from just 10 specimens representing two species, *A. sinuatipennis* Lieftinck, 1933, and *A. amphidactylis* Lieftinck, 1949. In October–November 2009 one of us (VJK), visited the Muller Range in the Western Province, Papua New Guinea as part of Conservation International's Rapid Assessment Program (RAP). Several Odonata new to science were collected, including a specimen clearly representing a new species of the genus *Arrhenocnemis*, which we describe here, together with notes on its habitat and habits. In July 2006 and October 2008, during fieldwork of the Kelompok Entomologi Papua (KEP) and the Universitas Cenderawasih, Jajapurah (UNCEN) in the Star Mountains in West Papua (Indonesia) VJK

collected three males and the unknown female of *A. amphidactylis* (Kalkman 2008), which is also described here for the first time. Terminology follows Westfall and May (2006), with exception of anal appendages, where we follow Watson *et al.* (1991).

Arrhenocnemis parvibullis sp. nov.

(Figs 1a-h)

Material examined

Holotype ♂: PAPUA NEW GUINEA, Western Province, CI Muller Range expedition, Camp 1 (Gugusu), 05° 43.751S, 142° 15.797E, 515 m asl, 04-11 ix 2009, leg VJ Kalkman; DNA-sample VJK0496, preserved in ethanol, RMNH.

Diagnosis

A small, lightly built damselfly; ground colour dark with bright blue-green markings on the thorax, anterior part of the head and dorsally at the base of most abdominal segments. Legs short with sparse, short, robust spines. Wings with open reticulation; distal margins crenulate. The species can be identified based on the combination of the following three characters: (1) distal margin of wings crenulated, (2) tarsi bearing long spines, one pair per segment, (3) front of synthorax with a pair of small protruberances (i.e. bullae), see Fig. 1g.

Description

Head: Somewhat elongate in profile. Labium pale ochraceous; medium lobe with deep 'U' shaped incision (Fig. 1c), the two lateral projections thus formed tipped with long setae; apex of lateral lobes and maxilla dark brown. Labrum bright apple green thinly bordered with dark brown; basally with small median streak and dark patches at postero-lateral corners. Mandibles exteriorly bright green with large dark brown spot anteriorly. Clypeus shining dark brown; surface of postclypeus and ridge between ante- and postclypeus strongly convex. Genae bright green to just below level of antennal sockets, the green extending diffusely as thin triangular streaks across anterior part of frons, not meeting centrally. Green area on genae almost bisected by squarish dark spot meeting lateral angle of clypeus. Frons matt black, sloping. Remainder of head matt black; vertex distinctly raised and with prominent occipital ridge. Antennae (Fig. 1b) with second segment broad and about same length as first. Eyes moderately small; dark above, apple green beneath.

Thorax: Prothorax: generally lacking strongly defined sculpturing and rather uniform in profile; dark with bright green markings. Anterior lobe distinctly raised in profile with well-defined groove delimiting it from median lobe; dorsally with bright green bar; small rounded anterior processes present at the lateral corners seen in dorsal view. Median lobe only slightly swollen in

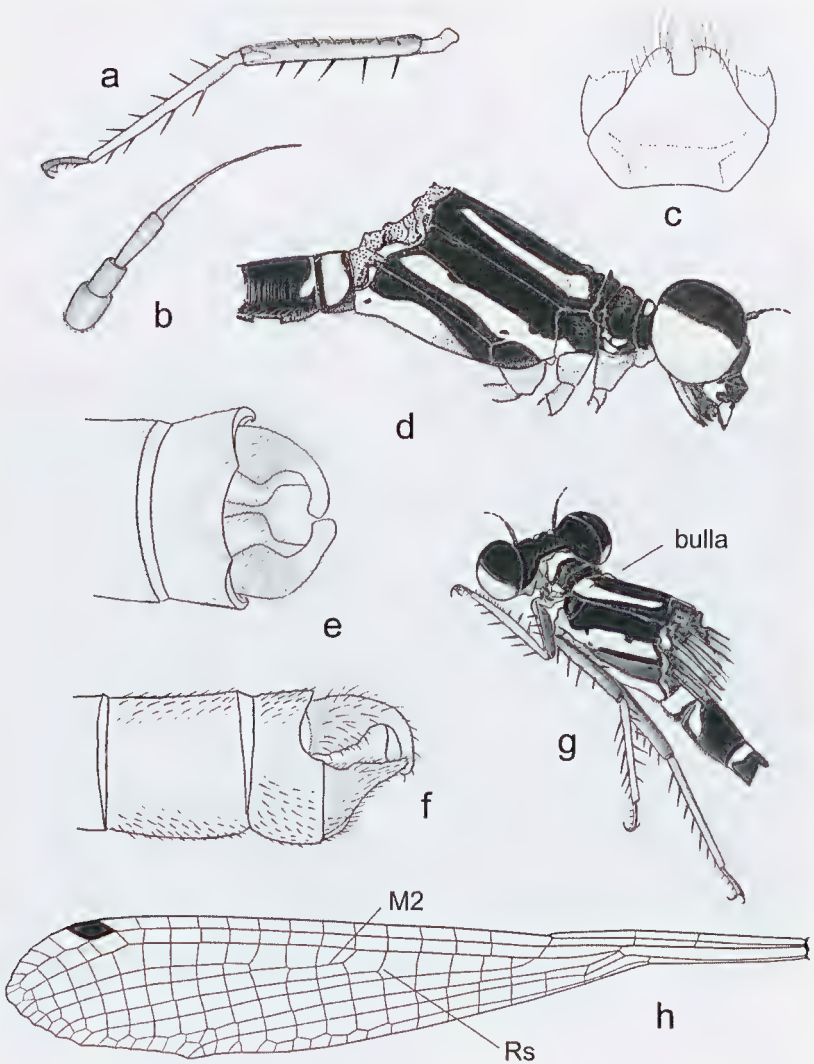


Fig. 1. Holotype male of *Arrhenocnemis parvibullis*: (a) metathoracic leg; (b) antenna; (c) labium detail, ventral view; (d) head and thorax in profile (head drawn forward slightly to reveal anterior lobe of prothorax); (e) anal appendages, dorsal view; (f) anal appendages, in profile; (g) head, thorax and base of abdomen, postero-dorsal view showing bullae on synthorax; (h) left hindwing.

profile, but in dorsal view clearly divided into two slightly bulbous postero-lateral lobes and an anterior depressed, inverted triangular area; laterally with distinct green marking at ventral margin, divided into three sections, extending to coxa (Fig. 1d). Posterior lobe black; only slightly raised at posterior margin; in dorsal view margin with two distinct, subapical, shallow incisions, defining rounded flaps at the lateral extremities of the lobe, only slightly evident in profile. Synthorax: mesepisternum marked with bright blue-green, moderately narrow antehumeral band, its anterior part enclosing a small protruberance (i.e. bulla – Fig. 1g), posteriorly curving gently back to terminate midway between dorsal carina and antehumeral suture, well short of the antearlar triangle. Laterally with diagonal bright blue-green band running from dorso-anterior half of metepisternum, across interpleural suture, to terminate in posteroventral part of mesepimeron, extending into posterior corner of mesoinfraepisternum and most of coxa; anterior margin of band incised at point of crossing suture. Metepisternum anteriorly dark, in posterior half becoming blue green then pale tawny. Venter pale ochreous. Post-sternum with dense fine, short setae. Legs: relatively short and bearing sparse, short, robust spines (Fig. 1a). Coxae pale or marked in green; femora robust; dark brown with posterior ridge; tibiae brown to pale ochreous from pro-meta thorax; pro- and metatibia especially, slightly flattened basally; tarsi dark, very short, each segment bearing strong ventral paired spines; tarsal claws apically bifid. Wings hyaline with black neuration (Fig. 1h); petiolated to just before level of Ax2; Ac nearer Ax2 than Ax1; Arc just beyond level of Ax2; M3 arising just beyond level of nodus; Rs arising at Px4, about midpoint of wing, and one cell before M2 in both wings; quadrilateral in forewing about 4 times as long as wide along posterior margin; postero-distal angle circa 63°; quadrilateral in hindwing about 5.5 times breadth at base; posterolateral angle circa 50°; wing margin in forewing crenulate to level of pterostigma, in hindwing crenulate to level of pterostigma and with strong protrusion at Cu1; pterostigmata in both wings lozenge-shaped and black.

Abdomen: Mainly dark with small green markings, slightly paler beneath; expanded at S1, S2 and from S8-S10, especially evident in dorsal view. S1 dorsally and laterally almost entirely green; S2 with small basal dorsolateral green marks; S3-S7 with dorsal green fleck basally. S8-10 black. Appendages mainly dark; superiors and inferiors subequal in length and slightly longer than S10. Superior in dorsal view (Fig. 1e) strongly incurved, with strong inner, rounded shoulder subbasally; in profile (Fig. 1f) basally thickened with apical process curved sharply downward with a slightly concave, spatulate apex, lying inside apices of inferiors; basally dark with long sparse setae; inferiors dark; in profile roughly triangular, tapering to a point; sparsely clad in setae except on outer and inner basal face; in dorsal view with strong inner shoulder at about their midpoint, thereafter tapering to thin, nearly straight, process.

Measurements: forewing, 23 mm; hindwing, 22.5 mm; abdomen + appendages, 31.5 mm.

Etymology

parvibullis: a noun in the ablative case derived from Latin *parva* + *bullia*, meaning ‘with small knobs’.

Habitat and biology

The new species was found at a small, 2 to 3 m wide, mostly shallow rocky brook in virgin submontane forest at 515 m a.s.l. (Fig. 2). The site was visited on several days but only one male was caught which was found sitting on the vegetation beside the stream.



Fig. 2. Small shallow stony brook in submontane forest in the Muller Range, 515 m a.s.l., type locality for *A. parvibullis* sp. nov.

Arrhenocnemis amphidactylis Lieftinck, 1949

(Figs 3 a-b)

Material examined

1 ♂: INDONESIA, Papua Province, Walmak (Nipsan), 04° 07S, 139° 38E, 1650 m asl, 29 x 2008, leg VJ Kalkman, DNA sample NG071; 1 ♀: INDONESIA, Papua Province, Walmak (Nipsan), 04° 07S, 139° 38E, 1650 m asl, 28 x 2008, leg VJ

Kalkman, DNA sample NG064; 1 ♀ INDONESIA, Papua Province, Star Mountains, Borne, 04° 23.745S, 140° 26.020E, 1000-1100 m asl, 27 vii 2006, leg VJ Kalkman.

Description of female

Head: Elongate in profile. Labium pale ochraceous; medium lobe with deep 'U' shaped incision, the two flanking lateral projections tipped with long setae; apex of lateral lobes and maxilla brownish. Labrum pale cream. Mandibles exteriorly pale cream with brownish tinge. Clypeus light brown; surface of postclypeus and ridge between ante- and postclypeus strongly convex. Remainder of front of head mainly cream, with pale green tint posteriorly, bisected by obscure pale brown, irregular band at the level of the antennal sockets and about the breadth of the sockets; vertex with distinctly raised and prominent occipital ridge. Antennae with second segment somewhat longer than first, almost equal in length to third segment which is rather short. Posterior part of head very dark brown, with line bisecting the vertex and encircling two lateral ocelli. Eyes moderately small; dark above, pale green to cream beneath.

Thorax: Prothorax saddle-shaped in profile with anterior and posterior lobes both raised in broad rounded lobes; dark above, ventro-laterally pale cream. Synthorax middle brown above with broad, pale green antehumeral bands; anteriorly, at the inner margin of the antehumeral stripes are paired finger-like projections, the outer side of these processes being green, the inner side brown. Laterally mainly pale green blending to cream ventrally with diffuse brown bands, one over mesepimeron, diagonally marking upper half of mesinfraepisternum, and another over metepisternum, enclosing spiracle. Legs relatively short and bearing sparse, robust spines; basally pale, with infuscation deeper in distal segments and at tibio-femoral joint, especially in prothoracic pair. Tarsi very short with strong paired ventral spines. Wings hyaline with black neuration; petiolated to just before level of Ax2; Ac slightly nearer Ax2 than Ax1; Arc just beyond level of Ax2; M3 arising at or just before subnodus; Rs arising at Px4 or Px5 in forewing, at Px3 or Px4 in hindwing; M2 at or near level of Px6 or Px7 in forewing, at or near Px5 or Px6 in hindwing; M1a arising at Px8, Px9 in forewing, at Px7 or Px8 in hindwing. Wing margin in forewing crenulate to level of pterostigma, in hindwing crenulate to level of pterostigma and with strong protrusion at Cu1; pterostigmata in both wings lozenge-shaped; dark reddish brown with very fine amber margin.

Abdomen: Medium build. Dark brown above, laterally and ventrally pale cream, progressively reduced to venter of posterior segments. S1 broadly greenish cream laterally, brown above; S2-S10 dorsally with moderately broad basal pale green fleck; in posterior segments before S10 tending to short streak along dosal carina. Terminal segments slightly clubbed and rounded apically. Valves pale, slender, slightly concave ventrally, with fine subterminal comb of dark setae and longer setae terminally; extending just

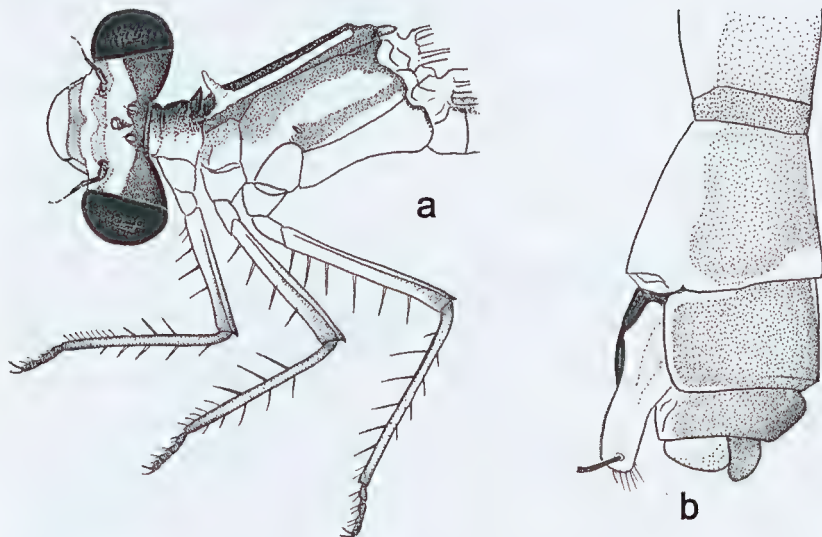


Fig. 3. Female *Arrhenocnemis amphidactylis*: (a) Dorsal view of head and lateral view of thorax showing anterior process on mesepisternum; (b) S8-S10 of abdomen, lateral view.

beyond pale anal tubercle. Anal appendages light brown, short, rounded apically and slightly downturned.

Measurements: forewing, 24-25.5 mm; hindwing, 22.5-24 mm; abdomen + appendages, 28-29 mm.

Comparison of male with type series

The single male examined agrees closely with Liefinck's (1949) descriptions of the holotype male and three paratypes with the following exceptions: green marking on head slightly more developed; left hindwing with Rs arising level with Px3 versus Px4 in types; abdomen with thin dorsal pale green streak along its entire length on S9 and a tiny dot of the same colour at the base of S10, apparently lacking in types. Relative to the type series the wings are slightly longer - hw 23 mm versus 21.5-22.5 mm in type series - and the abdomen plus appendages slightly shorter - 31 mm versus 32-33 mm in type series, hence the abdomen is discernibly slightly shorter relative to the wings.

The antennae (not mentioned by Liefinck 1949) are of similar proportion to those of female.

Habitat At Borne *A. amphidactylis* was caught at small, shaded and rocky brooks; at Nipsan it was found at small rocky brooks in an area where the vegetation had largely been cleared.

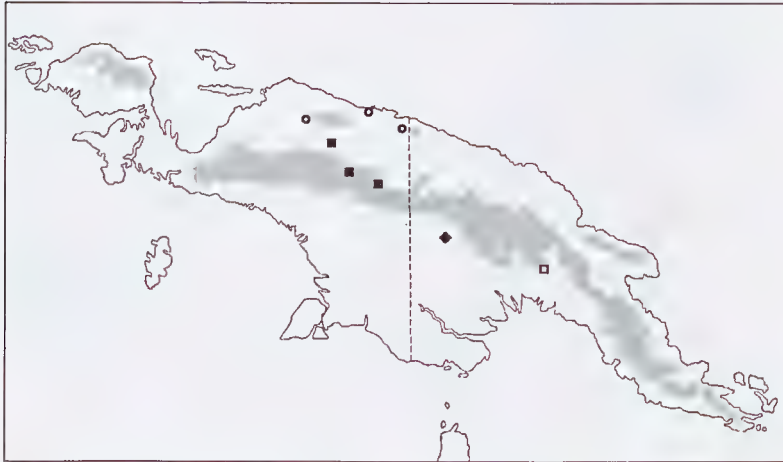


Fig. 4. Map of New Guinea showing locations for known *Arrhenocnemis* collections: open circles, *A. sinuatipennis*; solid squares, *A. amphidactylis*; solid diamond, *A. parvibullis*; open square, *A. sp. incertae sedis*. Grey shading indicates land over 1000m. a.s.l.

Discussion

Although Liefinck (1933), assigned the genus *Arrhenocnemis* to the Platycneminae (i.e. Platycnemididae *sensu stricto*), he subsequently placed it in the Megapodagrionidae (Liefinck 1965, 1971), where it appeared in subsequent catalogues (Davies and Tobin 1984; Tsuda 2000). However Gassmann (2005) reinstated it to the Platycnemididae-Calicnemiinae, where it clearly belongs. A unique character is the tarsi which are short and bear long spines, one pair per segment. This, combined with the crenulated margins at the wing tips, makes it easy to distinguish the members of this genus from any other New Guinean Zygoptera.

Other characters supporting the placement of *parvibullis* in *Arrhenocnemis* are: 1. The venation is almost identical to that of *sinuatipennis* and *amphidactylis* and unlike any other New Guinean calicnemiine genus, with

Rs arising well distal to nodus near M2. We are not aware of this condition in any zygopteran other than the Philippine genus *Risio cnemis*.

2. The legs are unusually short with stout, sparse spines.
3. The front of the head is relatively robust and elongated.
4. The labium has a U-shaped distal excavation, as described by Lief tinck (1949), which is wider than in any other New Guinean calicnemiine genus.
5. The general body shape and size are very like *sinuatipennis* and *amphidactylis*; coloration and markings distinctive but similar. The bullae on the thorax are reminiscent of the 'fingers' of *amphidactylis*, a structure unique in Zygoptera.

The unusual shortened second antennal segment found in *A. parvibullis* is not clearly evident in either of the other two described species, but Lief tinck (1933) notes that the antennae of *A. sinuatipennis* are overall short when compared with the southeast Asian genus *Coeliccia* Kirby, 1890 and other eastern genera of the family. This is true also of *A. amphidactylis*.

Thus far only 16 specimens of *Arrhenocnemis* have ever been collected. These represent a probable four species, from eight localities (Fig. 4). *A. amphidactylis* is distributed in the central mountain range from 700 to 1650m and *A. sinuatipennis* occurs in the hills in the north of West Papua from 165 to 400m. There is a record of an *Arrhenocnemis* sp. from Crater Mountain Biological Research Station published by Oppel (2005, 2006). No details are given and it is not clear if it is a new species, but given its occurrence so far from the known range of other species this seems very likely.

Acknowledgements

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